PHILIP MORRIS U. S. A.

INTER-OFFICE CORRESPONDENCE

Richmond, Virginia

To: Dr. Jerry Whidby Date: September 9, 1991

From: R. W. Dwyer

Subject: Current Operational Plan for Project Tomorrow

# PROJECT TOMORROW

## OBJECTIVE:

To evaluate the feasibility of developing an ignition-propensity test for cigarettes and to evaluate the technical and commercial feasibility of making cigarettes with reduced ignition propensities with respect to such a test.

## STATUS AND BACKGROUND:

On August 10, 1990, the Fire Safe Cigarette Act was signed into law. This law empowers the Consumer Product Safety Commission to direct the National Institute of Standards and Technology's Center for Fire Research to complete research on cigarette fire safety. Specifically, this law calls for CFR to develop a standard method for determining cigarette ignition propensities, to compile performance data for cigarettes using this standard method, and to conduct laboratory studies on and computer modelling of ignition physics.

In an effort to maintain our products as the best in the market, we are examining the question of their fire safety. The challenge is to determine if there is any reliable test for assessing cigarette fire safety or ignition propensity. If so, we then need to evaluate our ability to manufacture and sell products which show improved performance with respect to such a test.

It has been demonstrated that bands of materials applied to cigarette wrappers can reduce the mass burn rates of cigarettes made with these wrappers. In fact, such bands can cause extinguishment of freely smouldering cigarettes. To date, we have examined sol-gels, inorganic salts, cellulose suspensions, and paper strips as banding materials. The suspensions and strips appear promising. One anticipated problem with reduced-burn-rate zones is increased puff counts. However, recent experimental results suggest that zones of inorganic wrapper additives may cause more tobacco to be burned either during or directly after a puff, thereby reducing puff counts. Another major concern is the manufacture of banded wrappers. Jim Myracle's design of a modified ring tipper has been implemented and demonstrated to work on a laboratory scale. Printing technologies have shown promise in applying cellulose suspensions. Machine-made wrappers of both types have been used to fabricate cigarettes which have extinguished during free smoulder within the bands.

Another problem facing this program is the lack of an official cigarette ignition-propensity test. With such a test, we could design wrapper band-patterns to meet test standards. Our approach at this time is to design patterns such that the band width is just short of causing extinguishment during free smoulder and the band density does not seriously increase puff count. Our assumption is that we do not want to make cigarettes which will extinguish during free smoulder.

The Paper Technology Program has formulated detailed plans for the development of processes to apply bands to papers. Their plans include wet techniques such as the "daubing dandy" as well as printing technologies such as gravure, ink jet, and strip coating. Tim Callaham and John Hearn have issued their plans for refining our current version of the strip applicator. The plans given below under Strategy 4 include only the efforts to be undertaken within Project Tomorrow on burn-control zones in cigarette wrappers.

## STRATEGIES:

- 1 Evaluate the feasibility of developing a test for cigarette ignition propensities and determine the extent to which cigarette design parameters influence their performance with respect to such a test.

- 2 Develop a computer model of a smouldering cigarette in contact with a substrate in order to evaluate the effects of cigarette and fabric properties on ignition.

- 3 Design cigarettes at reduced mass burn rates while maintaining consumer-acceptable delivery, physical, and subjective properties to the greatest extent possible.

- 4 Explore new technologies which may lead to more fire-safe cigarettes.

## TACTICS AND TIMETABLE:

Strategy 1. Test Development

1. Evaluate the effects of fabric type, burn-promotion additives, and draft rates on the ignition of fabric/foam substrates. (2Q92)

2. Experimentally determine the thermal properties of smouldering cigarettes and fabric/foam substrates. (4Q91)

3. Determine the effects of cigarette design parameters on their thermal properties. (4Q91)

4. Determine whether correlations exist between ignition-propensity tests and the thermal properties of smouldering cigarettes and substrates. (2Q92)

5. Evaluate the technical feasibility of producing cigarettes with lower ignition-propensities with respect to a specified ignition test. (1992)

6. Implement the Center for Fire Research's ignition-propensity test and examine for correlations with our in-house tests. (1993, or sooner if available)

7. Determine the effects of cigarette thermal properties on the CFR IP test. (1993)

8. Evaluate the technical feasibility of producing cigarettes with lower ignition-propensities with respect to the CFR IP test. (1994)

Strategy 2. Computer Modelling

1. Develop a computer model of smouldering cigarettes which accounts for the effects of cigarette design parameters on cigarette heat flux; design and implement a companion experimental program to support the modelling effort and to validate results. (4Q91)

2. Develop a computer model of the temperature and oxygen distributions at the surface of fabric/foam substrates exposed to an external heat source which takes into account the properties of the materials, their treatment, the geometry of the test configuration, and the draft rates to which they are exposed. (1992)

3. Develop a computer model which predicts the probability of ignition of a smouldering cigarette on a fabric/foam substrate. (1992)

4. Exploit the model to determine the influences of cigarette design parameters on ignition propensities. (1993)

5. Obtain and evaluate the CFR's computer model of cigarette ignition propensities. (1993, or sooner if available)

6. Develop a computer model of a cigarette during puffing which accounts for the effects of cigarette design parameters on the weight of tobacco burned during a puff. (1994)

Strategy 3. Cigarette Design

1. Select acceptable design parameters for target cigarette models. (4Q91)

2. Develop low-density tobacco blends for new designs. (4Q91)

3. Fabricate, CTSD test, and subjectively evaluate low-MBR products; optimize subjectives through re-design where necessary. (2Q92)

4. Design, fabricate, and evaluate low-MBR versions of all PM cigarettes. (1993)

5. Evaluate commercial feasibility of manufacturing and selling cigarettes which demonstrate reduced ignition propensity with respect to the CFR IP test. (1995)

Strategy 4. New Technologies

1. Evaluate the effects of burn-control zones on the mass burn rates and ignition propensities of cigarettes in a given IP test. (On-going)

2. Evaluate the effects of burn-control zones on the thermal properties of cigarettes. (2Q92)

3. Investigate other technologies for improving cigarette fire-safety as we become aware of them. (On-going)

## IMPACT

The findings of Project Tomorrow could have a major impact on our products. It is possible that we may need to: 1) alter the way we process tobacco; 2) increase significantly the amount of expanded material in our blends; 3) reduce the lengths and/or circumferences of cigarettes; 4) procure, or modify in-house, novel cigarette wrappers. Each of these modifications could require fairly drastic changes in the production of cigarettes. Our goals for 1991 include evaluating the technical and commercial feasibility of increasing cigarette fire safety and assessing the impact such modifications will have.

PROJECT TOMORROW
RESOURCES

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|---|---|
| INTERNAL | |
| 1) Physical Research - IP testing; protocol development; modelling; wrapper studies; design | 8.5 |
| 2) Product Development - cigarette design; materials procurement; design optimization; banded wrappers | 5.0 |
| 3) Flavor Development - flavor systems; subjectives | 2.0 |
| 4) Tobacco Processing & Fabrication - production of cigarettes | 1.5 |
| 5) Cigarette Testing Services - CI evaluations;cigarette smoulder temperatures | 1.5 |
| 6) Paper Technology - wrapper studies; material procurement | 1.0 |
| 7) Leaf Department - blend design | 1.0 |
| 8) Analytical - determinations of KOAc; fabric ignition-temperatures; tobacco heats of combustion; wrapper chalk levels | 0.5 |
| 9) Engineering - process evaluation and implementation (banded wrappers & registration) | 0.5 |
| TOTAL | 20.6 |

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